

# SUPPLEMENT.

# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Royal School of Mines, Jermyn-Street.

MR. WARINGTON SMYTH'S LECTURES.

LECTURE II.—Mr. Smyth commenced his second lecture by remarking that there existed in the public mind, coupled with great ignorance of the conditions described on the previous day, much misapprehension as to the character of mining operations generally, taken from a pecuniary point of view. It was supposed that a man had only to buy a share or two in a copper, lead, or silver mine in order at once to reap considerable profit. It is assumed that a handsome interest at least is derived from all such investments. He was far from thinking that if money were properly placed in mining it would not reap its due reward, but it was most important that every man should understand the precarious tenure on which the property of every mine was placed, and more especially those opened on metalliferous veins. The only case in which a man could have any degree of certainty was when he had to deal with stratified beds, the position and character of which had been proved over a certain area. As to metalliferous mines, they must be looked on as mere adventures, the term usually, and most properly, applied to them. If, however, they had a certain amount of money, and could spread their operations over ten or twelve areas, as it were, excellent results might be counted on: but anyone deluded enough to put all his eggs into one basket would find that he had done a most foolish thing. This would be evident when they came to see the nature of the mineral deposits, and how capriciously distributed they were. The next point, however, now to be considered would be the more or less pure condition and nature of the mineral veins they had to work. He said more or less pure, because there might be a great difference in that respect, and yet a profit might be made. For instance, in the case of the iron ores, 30 per cent. of metal obtained from the material treated might give a profit; but if it had to be carried any considerable distance before it could be utilised by the smelter, 40 or 50 per cent. would be requisite to turn it to advantage. The case was very different when they came to metals of higher intrinsic value. For instance, in the case of lead, if they obtained 4 or 5 per cent. they might do very well; and particularly if in the dressing they had not to throw away a large amount of other metals. Thus, the treatment of galena depended upon the amount of silver in it. If it were highly argentiferous 20 to 25 tons of material might be dressed to obtain a single hundred-weight of saleable produce. Again, in the case of tin, the intrinsic value of which just now was exceptionally low, if they got 1 ton of merchantable produce from 100 tons of material it would be to pay very well. The great point then, was to avoid conditions under which the material could not be worked up without loss. One serious source of expense was the hardness of the rocks to be worked. If in one case it cost 10s. to break up 1 ton of ore, while in another it only cost 1s., it was evident that that was an important item to be taken into account. In respect to silver and gold, an extremely minute quantity might be enough to pay for the working of a mine. In some districts  $\frac{1}{4}$  oz. of gold to a ton of material was found to yield a sufficient profit; and in cases of silver, where there was the advantage of water-power, a smaller proportion might be profitable, and thus 3 ozs. of gold in 1000 cwt. of material was found in one of the continental mines to pay.

Taking for granted that his audience attended the geological lectures of Prof. Ramsay, it would be enough for him to describe the rocks which form the crust of the earth as divided into two great classes—the stratified and the unstratified—and of these he was about to speak from a mining point of view. With regard to the stratified deposits, they would find that the masses of the same material in some places, and in others a large number of different materials within a small compass. Thus, there were examples of limestone beds 1000 or 1500 ft. in thickness, in which it was impossible to see any lines or partings to indicate any separate deposits in it. On the other hand, if they took a section through the coal measures they would get within a small compass a great number of beds. This was a point which often came into play in an important manner in mining; as within a short distance of each other they might find separate deposits of value, so that it might be a question whether they should be worked together or separately, and, if separately, whether the upper or the under bed should be first attacked. It is a generally received opinion that these beds were all deposited originally in a horizontal position; and in some countries—as in Russia and America—they are so found, stretching over enormous tracts of territory. Even in England they will be found over a considerable area, but more frequently lifted up, and devaluing at greater or less angles from the horizontal position. The strata have received a great variety of names, and are called beds, seams, delfs, measures, girdles, posts, and mines, the latter word being unfortunately used in some places for the beds rather than the workings. When the beds were thus lifted or tilted, as long as it was at a moderate angle, there was but little difficulty in comprehending their position, and of following any particular band they might have to work; but sometimes they were in the highest degree twisted and dislocated, and then it was often a matter of great difficulty when they came to a fault to find where the lode or seam was again to be met with. One great assistance was the parallelism of the beds; so that in any district if they found a seam of coal placed between sandstone and clay they might be sure of finding in any part of that district, and in others adjacent if they do not go far away, the same arrangement. Having by means of diagrams illustrated this parallelism, he explained the strike and direction of the beds, and the dip, or deviation from the horizontal line, and cautioned the students against the error of supposing that the thickness of a seam was the measure of its value. For instance, that of the Mostyn pits, near the mouth of the Dee; that of the Earl of Lonsdale, at Whitehaven; the great Barnsley seam, upon which the late terrible accident occurred; and that belonging chiefly to the Earl of Dudley, in Staffordshire, called the Ten-Yard seam, from that being about its average thickness. In France there were beds 60 and 70 ft. thick, in some places reaching to 100 feet, but where the horizontality was greatly disturbed. All these varieties of condition rendered different modes of working necessary. Another peculiarity of the stratified deposits was that at different parts of a stratum the texture of the material was sometimes altered, perhaps in some of its most important qualities, by difference of pressure or the influence of superincumbent beds. This had sometimes led to great disappointments; one of the most notable of which was that of the building stone used for the new Houses of Parliament. The premature perishing of that stone, which everyone must regret, had led many persons to suppose that a bad choice had been made. That was not so, as the stone had been proved to be of exceeding durability by existing edifices; but it was followed in the quarries over too large a tract of country, and what was good at the place where it was first quarried was three or four miles off of a more friable and less durable character. These changes was so common that even in one quarry the same stone would sometimes be found of both good and bad quality. The remainder of the lecture was occupied by drawings on the board, diagrams, and models, showing the way in which faults, dykes, leaps, jumps, traps, throws, names which all represented different examples of the same thing, occurred in the stratified deposits.

LECTURE III.—After mentioning several additional facts with reference to stratified deposits, Mr. SMYTH passed on to notice those of alluvial origin, of which formerly little account was taken, except in Cornwall, when they were worked for tin. Since the Californian gold discoveries, deposits of this kind had come more into notice. These deposits mostly lay on or near the surface, and varied in every possible degree as to thickness and size, from a few inches to 300 or 400 ft. In the earlier periods of mining the methods were so imperfect that even to this day there was always somebody working over the old stuff, and finding a little, although, perhaps, only just sufficient to give them a small wage. The gold of California and New South Wales was at first discovered near the surface, perhaps in digging a ditch, or in making a course for a water-wheel, which was actually the case in Australia. Then the began to work more systematically,

and they found that, after removing a little vegetable mould, or surface sand there was a deposit lying on the solid rock, called "tin ground," or the gold-bearing ground. It was also called the "pay-dirt," meaning "the dirt that pays." As long as the conditions were of this kind, the great simplicity of the arrangements under which the working was carried on could easily be understood. One man would sink a hole by the side of another, generally about 12 ft. square; they threw out the rubbish, and then, after going over the stuff and extracting all that was valuable, they threw the rubbish back again. But in places where the pay-dirt existed in greater masses, as at the bottom of gully lodes, and they had to go to 80 or 100 ft. down (which was frequently the case in Australia), it was not worth a man's while to incur the necessary expenses for excavating so deep a space as 12 ft. (the usual dimensions of a concession), and then the principle of association came into play. Men clubbed their various grounds together, and obtained extended rights; and then they sunk shafts, and thus worked out the whole of a given area. In conceding rights to the miners, the authorities after awhile adopted the principle of reckoning by frontages along the line of the lode, and as much as 30 ft. was not an unusual piece to take. In working out these deposits sandy and gravelly beds were found in regular layers; and then, in the loam below all these, came the gold deposits, resting on the old original surface. A number of frontages were, on the same principle of association, joined together, a shaft sunk, workings driven out all over the area, and the profits divided amongst the partners; many of these adventurers having thus accumulated very considerable sums indeed. He mentioned this to show how, in new countries, the conditions under which mines were worked had to be remodelled, because people at first were unable to form any idea as to the nature and extent to which the later operations would require to be carried; indeed, such modifications were sometimes found necessary in old countries; as, for instance, quite recently in Servia a new code of mining laws had been promulgated, by which greater facilities were given to mining adventurers, and far more liberal terms imposed. Alluvial deposits required to be carefully studied and taken into consideration, even in respect to mining of other kinds. It was surprising sometimes to find in what unexpected positions these deposits were located. At the Alexandra Slate Quarry, not far from Carnarvon, there was lying, at 1500 ft. above the sea level, on the top of a hill called Moel Tryfan, a deposit of sea sand and shells, covering some extremely valuable slate rock. After carrying on operations for a long time, and expending a great deal of money, this overlying deposit was found to be so thick that the operations had to be discontinued. The proper way of dealing with a case of this kind would have been to have ascertained by borings the exact facts, and then it would have been easy to have come to a right conclusion as to the proper method of working. If that had been done they would have probably sunk a shaft, or have gone some distance and dug on a level, to tap the water, and enable them to bring away the slate. Veins, or lodes, although they differed so much from one another, and even in different parts from themselves, had certain elements in common. Generally speaking, they were contained between two walls, or sides, often continued for a very great distance, and with a considerable degree of regularity. The great geologist, Werner, of Saxony, was the first person to see the true character of veins, and his view was now generally adopted. His view was that a vein had been a fissure, which, after remaining open for a certain length of time, was filled up with a variety of minerals, metallic, or non-metallic. These veins when very large went by the name of master, or champion lodes, and when small they were called branches, or strings, but in all these there was a general character—that of occupying a position inclining to the vertical, and, in fact, seldom diverging more than 45° from the perpendicular. They often extended to a great length, and they went down to depths far beyond those to which man had yet succeeded in penetrating. Veins were always supposed by the uneducated to be, more or less, filled with ore, and it was a great gain if shareholders had a little more knowledge of the subject, so that they might be more competent to form just opinions of the value of mines. It was altogether an exceptional thing to find metals in a vein in a pure condition; even the richest ores were intermingled with valueless substances, and of these combinations the Museum presented a collection of examples, principally British, which had been selected with such care that if they were to spend 12 months without intermission in visiting the mines themselves they could not see anything so illustrative as the specimens upstairs, grouped so as to illustrate certain phenomena. It might be asked, how when they came to any deposit of minerals they were to distinguish a vein from a stratified bed, particularly as some beds were elevated at a considerable angle? The difference in theory was easily enough stated. Stratification was the deposit of a succession of beds one upon another, while a vein, as he had just stated, was a fracture, or fissure, in that stratification, into which other and different minerals had been introduced. There were, however, frequently cases in which it was difficult to distinguish between the two. A case of this sort occurred in the interesting group of mines in the Vale of Avoca, notable for the enormous quantity of iron pyrites there worked. The rocks there ran in the same direction as the deposit, and dipped at the same angle, so that it really appeared to be a stratified metalliferous deposit. When, however, they cut transversely into the country, it was clearly shown that the deposit of copper and iron pyrites was of subsequent origin to that of the beds. The lecturer then gave a considerable number of similar instances, and described at length many of the most noted lodes, or metalliferous veins, known throughout the world.

LECTURE IV.—After enumerating the various localities throughout the world in which mineral veins are worked, the lecturer continued his remarks on the materials to be met with on the two walls of a vein. In well characterised veins the two walls were perfectly distinct and distinguishable, showing plainly where the lode began and where the country left off. In the case of a district where the rock was granite, and the ore-bearing vein consisted of quartz or calcareous spar, there would be no difficulty in making out the line accurately, but there were cases going through an entire district, where the walls, or one of them at least, would not be well defined, and where even miners, brought up in the district, would be puzzled to know whether they were in the lode or out of it. He recollected, in the county of Wicklow, the case of a vein where one wall was well marked, but the other completely deficient of indications as to where the vein left off, which, of course, very much interfered with the progress of the work. Where the wall was well defined, the miners had a prejudice in favour of its productiveness, which might or might not have a good foundation, but there was no doubt that it was a great advantage. In such cases there would be mostly found on the hanging side a thin band of clay, often no broader than the blade of a knife, called "a sticking." This showed exactly where the division was, and enabled the miner unhesitatingly to follow the vein through the country. It was also of great assistance to the miner in detaching the vein from the rock or country, and it almost invariably gave evidence of there having been a sliding motion on the side of the vein. In cases where there was not a line of "sticking," they would find the material of the country at some distance from the vein would appear to have been changed by the action of the vein. This was not unfrequently the case in tin veins, where it seemed as if an amount of silica had been diffused through it, and with it very frequently a considerable quantity of metalliferous deposit. This was caused by segregation from the country. It was often seen in Cornwall, where at a little distance from the lode, and in the rock would be impregnated with tin; and the same appearances were observed where cross veins passed through for some distance from the intersection. Again, in Saxony native silver was found traceable from the wall of the vein into the face of the rock, and in such cases the rock was systematically broken down for the extraction of that silver. At Kongsberg, in Norway, this appearance took the form of small plates and little strings of native silver, and there the rock was broken down on both sides for the purpose of extracting the precious metal. The same thing was noticeable in the neighbourhood of gold and copper veins. These peculiar appearances had often proved a great advantage when miners were driving cross-cuts to explore the country, for it not unfrequently happened that just as they were about to give up a piece of ground as wholly barren, the discovery of particles of metallic mineral diffused through the rock was a certain indication to them that they were approaching the wall or side of a vein. There was one substance found within the walls of veins of a peculiar character, called "capel." It was a dark-grey siliceous substance, 19-20ths of an inch in thickness, having in it small specks of copper or iron pyrites. Sometimes granules of it were found in it, and then it was called tinny capel, and was often worth working. The extreme hardness of this substance, and consequently the great expense of driving in it, or cross-cutting it to test its character, caused the miners to look upon it as a formidable enemy. It was sometimes found of a curiously crystallised character, with specks and spots of quartz, intermixed with that beautiful substance called tourmaline; sometimes by the diffusion of other mixtures it was of a black colour, and then the miners

called it cockle. The two walls of a vein in a mine might present aspects of a very different character indeed. In some the material might break away with facility, and others might require the use of gunpowder, so that when the vein becomes small they may be doubtful whether they are working in the vein at all. Thus it became a frequent duty of the mining engineer or captain to go down and consult with the managers whether they were in the lode or not—whether what they were working represented the lode, or whether it had entirely vanished. It frequently happened that a lode would become small and poor, narrowing to 1 or 2 inches, or mixing with the country until it had no definite line, leaving hardly a string or an indication by which it might be recognised as a vein. To meet cases of this kind, the student should prepare himself by becoming familiar with every sort of change, common or uncommon, that was to be met with, because he might otherwise suggest the discontinuance of efforts which if they were followed up would bring the workman again into productive ground. As an instance in which such a thing had happened, he quoted the case of the famous Pozo Ancho Lead Mine, in South America, where a rib of quartz a few inches in thickness, and which could scarcely be spoken of at all as lead ore, was worked because the character of the ore was thought to indicate unusual richness, but which, after a time, died away. The miners sunk an additional depth, recovered the vein in a workable condition, and soon afterwards saw it open out to an enormous thickness—so thick that it had to be worked with galleries. Another very important matter which the miner must carefully study was the association of minerals, by which he meant that grouping of substances in a vein which indicated different metals. Thus, if they were exploring a poor vein, and found a certain association of substances, they might be certain they would not find (say) tin, for instance, as tin was never met with in company with those materials; and, again, with another group of materials they might be able to predict, with certainty, the presence of metallic ores. Thus, tin ore was always found in connection with a peculiar mother-of-pearl sort of lustrous mica, arsenical pyrites, and fluor-spar; and, therefore, if they met with these substances they might continue their search with a confident expectation of meeting with tin ore. The material generally with which the lodes were filled was called vein-stone, or the matrix, and sometimes the "gangue," although they would only find this latter term in books, and must not confound it with the word "gangue," which, in the German language, meant the lode. The structure of veins required a few moments consideration. In many cases that structure presented the appearance of parallel ribs or bars; in others, irregular fragments, cemented together. In these ribbed structures it was quite clear that each bar had been placed and consolidated before another material was placed upon it. In these cases they would find on each wall of the vein a deposit of the same material; then, on the surface of that, a second substance; then, again, a third, and occasionally a fourth. There were cases in which these bands were much more numerous; as, for instance, at Freiberg from 12 to 20 successive bands might be counted. There were a few such cases in England. In the Restormel lode, in the Lostwithiel Mines, there were a great number of bands. It was this mine which was visited by the Prince and Princess of Wales, and as these bands were highly crystalline, they contrasted well with the dark killas of the neighbourhood, and were thus brought out with a distinctness and brilliancy which greatly interested the Royal visitors. In some places, or parts of the larger lodes, the miners sometimes discovered large cavernous holes, which were locally called "boots." In these places the veins were often found well crystallised, and the interior was often very beautiful indeed. These caverns were often many feet in height and length, and of considerable breadth, and from them were obtained some of the most beautiful specimens of pseudo-morphous forms of minerals with which science was acquainted. A very curious incident was pointed out to him when last in Cornwall in reference to one of these cavities. A friend of his at St. Just picked up from the floor of it a piece of crystallised quartz, with various minerals attached to it; a few days afterwards one of the miners broke off a piece from the roof of the same cavity, and thinking it was a very pretty specimen, took it up to the office of his (Mr. Smyth's) friend. It was accidentally observed that the two pieces fitted accurately together, the one found on the floor having been evidently detached from the other by some internal movement in the cavity. At the point of fracture a sort of thin coating of brown spar had formed, showing that the fracture had taken place from natural causes a long time ago. He now came to the most important question of all—how the minerals were distributed in the vein. At present they had only been looking at what was between the two walls, but they must sink a shaft and drive out levels in order to see what a vein was made of. Referring to a large longitudinal section of the workings at Teague's lode, Mr. Smyth said they would see that there was no rule or regularity in the manner in which the ore portions of the veins were distributed, and that was the chief difficulty which beset mining operations. Whether or not it would ever become possible, from appearances at the surface, or in any other way, to say that one portion of a lode would yield ore and another would not, was conceivable. Referring to the large geological map of Cornwall, they would see that the lodes thereon depicted averaged from a mile to a mile and a half in length, and some were traceable to greater lengths. In some cases, as in that of the Good Fortune Mine, in South Cornwall, a lode after being highly productive for a mile, or a mile and a half, would break away into strings, and seem to die away into the country. In other cases, the lode might come upon another class of rock, and thus be brought to a sudden termination. As an instance of this, he would mention that at the southern extremity of the mine at Laxey, in the Isle of Man, the lode which before had been highly productive could not be traced with any satisfaction. It ran from north to south, at a width varying from 6 to 10 feet, but at last broke away into poor material, with a few indistinct strings, so that it was difficult to say which was the vein. Several of the most promising had been followed to a considerable distance at a great expense, but none of them had proved the true vein. One of the most remarkable lodes as regarded profit at the present time was Great Devon Consols, in the neighbourhood of Tavistock, which had been traced for three miles, and had yielded 1,000,000, sterling of pure profit. It ran from north to south, but what became of it on the east and west? It was a sort of bank, which nobody liked to lose sight of, but on the west the lode seemed to be dislocated by a cross vein. Great researches had been made beyond that point, and first one would proclaim "I have got the Great Devon Consols," and then another would say the same, and schemes would be put forward to work these discoveries, by which the shareholders were to make fortunes at once; but the true lode had not yet been found after all. There was, no doubt, a tract of country for miles in the direct line of the Devon Consols, but it did not follow that the lode was there, or if it were, that it would be as rich as the worked portions; in fact, a lode, magnificent as to size, but utterly worthless so far as it had been explored, had been discovered at some miles distance, but which probably belonged to the same series of fissures as the Great Devon Consols. The lecture was brought to a close with notices of other lengthy veins, including those of Cardiganshire and Plynlimon, in Wales; Freiberg, in Saxony; and Schemnitz, in Hungary, as well as those of California, which, although their size and richness had been much exaggerated, were really very productive, well-defined, and were traceable to considerable distances.

ROTARY PUMP.—The improved pump invented by Mr. J. H. WINDER has a screw, or part screw, applied upon an axle to work within a cylindrical case. The case has an inlet passage at one end or side thereof, and an outlet passage at another. Each thread, or part thread, or wing, or a portion thereof in suc-



cession makes contract with the inlet passage, and these parts of the threads or wings may, if desired, be provided with suitable packing. The apparatus may be placed horizontally, vertically, or obliquely, and be worked by hand or power. Valves may be applied to the inlet and outlet passages when necessary. In adapting this pump for the free passage of thick or muddy substances it makes the screw and cylinder to revolve together within an outer case. Advantages amongst others to be obtained by a pump thus formed and arranged are great suction and forcing powers, ease of working, and general adaptability.

#### GOVERNMENT INSPECTION OF COAL MINES—No. II.

As to the SOUTH DURHAM district, Mr. J. J. ATKINSON reports that the number of deaths from explosions is unusually large for this district, which, in general, may be regarded as having been remarkably free from seriously fatal accidents of this nature for some years past, when the fiery character and great extent of many of the mines are taken into consideration. The deaths from falls of coal and stone in the mines of the district during the past year have been 23 in number, compared with an average number of 28 per year during the preceding four years. The deaths from shaft accidents during the past year have been one more in number than those which resulted yearly, upon an average of the preceding four years. The deaths that have occurred in the mines of the district from accidents of a miscellaneous character (consisting, for the most part, of crushes by tubs) have been unusually numerous during the past year, the number having amounted to 49 during the past year; while, on the average, the number per year during the preceding four years was only 23.

Although it may, he thinks, reasonably be hoped that this great increase is only of a temporary character, as he perceives no apparent cause for it, yet it is sufficiently striking to direct the special attention of all persons concerned towards the prevention of such accidents. The great distances which some of the workmen and boys have to travel in the extensive mines of this district before reaching and after leaving their work hold out great temptations for them to ride upon trains of coal tubs in engine-plans, where they are, by the regulations of the collieries, prohibited from doing so, owing to the dangers attending the practice. Only one of the accidents classed as miscellaneous underground accidents during the past year have resulted in more than one death, and five lives were lost by that accident while the sufferers were riding upon a train of tubs, contrary to the regulations in force at the colliery. The train upon which they were riding was run into by tubs from another way, the persons in charge of them having allowed them to run again, through being unable to stop them. On the whole, the deaths that have resulted from underground accidents in the mines of the district have been much more numerous during the past year than usual, the increase being chiefly due to the deaths from explosions of fire-damp and to crushes by tubs. The deaths from accidents on the surface at and about the mines of the district have been rather fewer in number during the past year than on the average per year during the preceding four years. Four accidents during the past year have proved fatal to more than one person each.

Referring to machine ventilation, Mr. Atkinson's report contains some important remarks on the evidence of Mr. Armstrong, taken at the inquest concerning the explosion at the Pelton Colliery, Durham. He says:—"I have seen several fans in different parts of the kingdom, and had examined two at work in this district, one at Elswick and another at Tursdale Collieries, and as we only obtained 7000 cubic feet of air per minute from the addition of the second furnace, it was useless to furnish, and I consider with our inspector, Mr. Atkinson, as to the most efficient ventilating power for the case. We agreed that the fan patented by Mr. Galt, of Belgium, was the most efficient, and an agreement was made with Mr. Galt for the erection of this fan. One condition of the agreement was that it should be of such power as to extract 100,000 cubic feet of air through the workings of our colliery per minute, when subjected to a frictional resistance equivalent to 3 inches of water, or, in other words, the fan was to extract 100,000 cubic feet of air per minute through the pit, when subjected to an aggregate friction represented by a column of water 3 inches high, or 15 lbs. per square foot. The fan erected was 30 feet in diameter, and 10 feet in breadth, and it was started on Oct. 21, 1865, little more than a year ago. Before Mr. Galt was entitled to his money for it the fan had to be tested, to see whether the condition of 100,000 cubic feet of air per minute through the workings was performed or not. This test was made, and we found that by keeping the motion of the fan as nearly uniform as possible, at 64 revolutions per minute we obtained with a water-gauge of 2½ inches 98,488 cubic feet of air per minute, as an average main ventilating current; and with water-gauges varying from 2½ to 3 inches, we obtained from 91,000 to 98,000 cubic feet, to 108,000 cubic feet as a maximum, per minute. About the same time, and before finally adopting the fan as the ventilating power for both seams, some experiments were made with the two furnaces, and it was found that with a water-gauge of 9-10ths of an inch, which was about the highest that the furnaces could produce, the main current in the Hutton seam was only about 31,720 cubic feet per minute, and that when the small ventilation of the Busty Bank seam was shut off, and the two furnaces limited to the Hutton seam only, not more than 55,448 cubic feet of air per minute as a maximum current could be exhausted. We then adopted the fan to work both the Hutton and Busty Pits; this was in October, 1865. The fact is that from the depth and nature of the workings the ventilating column here is so small that the fan is peculiarly applicable. In the Busty seam there is one downcast shaft 10½ ft. in diameter, and one up-cast. After the fan was applied as the chief ventilating power of the colliery we ascertained that we got 44,256 cubic feet of air per minute in the Hutton seam, and 21,700 cubic feet into the Busty; our last measurement, on Oct. 21st, showed 41,400 cubic feet of air per minute in the Busty, and 23,280 into the Busty. We had regulators for the different air-pits in the Busty seam, and by enlarging or contracting these we augmented or diminished our ventilating current in the several inby ways, and as the Busty Bank seam was extended, we from time to time added to their air-currents, having the most perfect control over the quantity by these regulators. The workings in the Busty Bank seam are divided into two districts, the north and the south. The workings of the latter are comprised within an area of seven acres, whilst the north does not exceed four acres. The fan has been constantly at work from the first day of its erection to the present moment. We stop it on Sunday mornings for short times, to determine that all the fittings are complete, we oil the machinery belonging to it three or four times every day, never stopping its motion, but only reducing its velocity."

Concerning the Manchester district, Mr. DICKINSON gives nothing but technical details, the suggestions he has to make being embodied in his report upon the Oaks Colliery, in reference to which he states that he is well aware that the system of working coal in any district is not a thing to be interfered with, except upon clearly different grounds. It has generally been arrived at after the trial of a great number of different modes, and is that which is found to be the best under all circumstances. To attempt to interfere with the recognised system of a district, except at a time like this, when the perception of everyone is quickened, would be certain to produce no good effect; but the necessity has, to his mind, now appeared, and it behoves the mining engineers interested in the management of these mines to forthwith take the matter into their most serious consideration, in order that a suitable system may be introduced. To bring about an altered system will be a work of time, even if it be set about at once, and great explosions may happen during the transition. In the course of the enquiry various suggestions were given by the witnesses as to how the system of working should be modified. In the opinions of some safety was to be found by working the faces down the hill, instead of up, so as to keep the gas away from the face of work, whilst others considered that course would be dangerous, on account of the risk of the roof being forced down by the weight, and that the accidents which would in that way be caused would be more serious than those which would be avoided. Another proposition was to modify the old system of working in banks, so that the working faces should go horizontally and at the low sides of the goaves, involving the working faces of the coal, as the seam lies here, to be on the end of the cleavage instead of on the face, as usually practised, and which is only seldom found to be advantageous in practice.

What is called the panel system—that is, by dividing the colliery into distinct compartments, was also proposed, but in no instance did any witness know of any colliery that was being so worked, and it was stated that one of the greatest explosions in the Wallsend Colliery took place when this system was being tried. It may be premature, he observes, to suggest at present what, in his opinion, the system should be; but, from what has come under his observation, he is strongly impressed with the view that the system which he brought under the notice of the Select Committee of the House of Commons on Mines last year, and to the extension of which system in his district he attributed the diminution which had taken place in the number of accidents and lives lost, concurrently with a large increase in the number of persons employed, is suitable for this seam. Under this system the levels are first driven out to the far ends, and the coal worked back from the extremities, having a substantial pack-wall built about 3 yards in width, at the side of each working face. In this way all the goaves are left behind, and the pack-walls support the roof, and enable the ventilation to be kept up in the goaves sufficiently far from the working faces.

By having more men in the same face of work than only two in from about 2 to as much as 30 yards, as practised at Barnsley, the space of pit room requisite to be kept open at one time might be much lessened, and the ventilation simplified. In Lancashire as many as eight men are sometimes put into such spaces of work as the above named. Putting so many men into one place is not, however, unattended with some disadvantages, as men, when crowded together, cannot get so well on with their work, and the noise sometimes prevents them from hearing when falls of roof and coal are about to take place, so that accidents from this cause become more numerous. The accidents in Yorkshire from all causes have been in proportion to the coal raised and the number of persons employed, the great drawback being the occasional occurrence of very serious explosions. Under the present system the coal is got at as cheap a rate as any, but it has the counterbalancing disadvantage that a colliery owner may have a splendid property one day, and the next day it may be a wreck, and the pits, as in this instance, be closed.

It has been suggested that the area of coal to be worked by a pair of shafts, and the number of persons allowed to be down at one time, should be limited; and this view is entertained by some mining engineers whose opinions he respects. For his own part, he considers that we live in the days of progress, and that as the sinkings become deeper we shall have to extend the area and increase the number of men. He looks for increased safety to having the workings upon a proper system, such as he has recommended, and which answers well, and is found to be economical in the long run in his own district.

**HOT-AIR STOVES FOR BLAST-FURNACES.**—In ordinary stoves of this description the air is caused to circulate through pipes placed in a chamber, which is heated either by means of waste gases from a furnace or by means of coal or other solid fuel. In both cases the air required for supporting the combustion is taken directly from the exterior in a comparatively cold state. The improvements of Mr. R. Howson, of Middlesbrough-on-Tees, consist—firstly, in placing in the chamber in addition to the ordinary blast-pipes other pipes through which the air required for the combustion of the gas or fuel may circulate, so as to acquire a considerable temperature before coming to the blast; secondly, in constructing the walls or brickwork of the stove with flues or hollow spaces through which the air may circulate for the same purpose; thirdly, in using a separate

stove or chamber for heating the air for the same purpose. By these means he obtains more perfect combustion and better results in an economical point of view.

#### THE TWO GREAT COLLIERY SHAFTS OF ENGLAND AND AMERICA.

THE ASTLEY DEEP PIT, ON THE DUKINFIELD ESTATE, NEAR MANCHESTER, ENGLAND, AND THE WADSWORTH SHAFT OF THE MAMMOTH VEIN CONSOLIDATED COAL COMPANY, NEAR POTTSVILLE, PA.

The slope workings of the Mammoth Vein Consolidated Coal Company at St. Clair, in Schuylkill county, Pennsylvania, have reached a depth of 400 yards, on an average angle of 19½° south, in the Mammoth coal bed. Their main gangway westward is now 9600 ft. long, commanding an area of about 130 acres of Mammoth coal, which bed has an average thickness of 30 ft. The quality of its coal has no superior as a pure white ash, in fact it is as nearly simple carbon as is found in the shape of a fuel. From this slope of 400 yards 4 lifts have been worked, and the coal hoisted by one engine of 60-horse power. Two pumping engines are used one lifting the water 200 yards into a sump or reservoir, and the other from this sump to the surface. The width of coal from the gangway to the surface increases as the bed crops higher up the mountain going westward, and at the highest point is 1800 ft. wide, where the main airway of the mine is driven through to the surface and where the mine is ventilated by an exhaust-fan of 12 ft. diameter, driven by a steam-engine of 25-horse power at a rate of 200 revolutions per minute. To get an idea of the ventilation of this colliery a true conception of the magnitude of the inside workings must first be had. Overlying the Mammoth bed with but 15 or 20 ft. of slate intervening, is another bed of coal known as the "Seven-foot," the average thickness of which is 10 feet. About 300 yards west of the foot of the slope on the Mammoth bed a tunnel is driven southward from it into this 7-ft. bed, and a gangway driven in it about parallel with the gangway on the Mammoth vein, and quite as far westward. From these two points the coal is mined out, and the workings, though systematic, ramify in all directions until the whole area is catcombed or mined out. Into and through all these workings there must pass a current of air to supply the workmen, and to carry off the gases generated in the mine. By aid of the exhaust fan the air is drawn down the slope and through the main gangway, until it reaches the tunnel to the 7-ft. vein. In the main gangway just inside of the mouth of the tunnel a strong door is placed, which divides or splits the air current, turning one-half of it through the workings of the Mammoth bed; near the west end of the mine these two currents are again united and thence by the fan drawn out to the surface. The area thus ventilated is about 260 acres or 130 acres on each vein. The 7-ft. vein is a clear white-ash coal, a trifle harder and rougher than the Mammoth. It is here, and generally, worked in connection with the former by means of tunnels from one to the other at convenient distances. The extent of the workings very generally conform to those in the lower and larger bed. There remains necessarily a large amount of unworked coal in the upper and supports left to sustain the top or roof of the mines, to give access through the coal to the surface, and to drain it, nevertheless with a thickness of 25 ft. in the Mammoth bed, and 10 ft. in the 7-ft. bed, the yield of coal must be very great, every acre producing, if cleaned perfectly clean, 56,446 tons. The product of this colliery since 1848 is as follows:—

Year	Tons	Year	Tons
1848	37,744	1858	104,087
1849	37,013	1859	127,020
1850	56,397	1860	116,119
1851	70,343	1861	120,248
1852	70,366	1862	122,445
1853	78,502	1863	98,579
1854	107,311	1864	95,726
1855	120,894	1865	48,346
1856	116,973	1866	85,109
1857	81,135		

An average of 54,576 tons yearly, for 19 years, and a total of 1,006,955 tons. The waste however, is very great; nearly one-half is an entresol. No gleaner can recover it, and no men, not even whalers, are more venturesome than miners; braving the dangerous explosions of fire-damp, or the equally fatal choke-damp, the blasts of powder and the roar of the great guns, they will go to the bottom of a shaft, and rob a mine, as it is technically called, is the attempt to remove the pillars of coal left to support the roof of the mine. This is an exceedingly dangerous operation. These pillars of coal stand but 10 or 12 yards apart for a mile in length, and a hundred yards in width, they support an enormous pressure of rock, slate, and earth. Blasting them away brings down a mountain, and endangers all within its influence, sometimes in detached falls of tons of rock, at other times the whole space gradually settles down with a terrible slow weight, and a fearful rush of wind, driven out with the violence of a storm. To avoid this older and catcombed part of the mine, this enterprising company were induced to open into a larger body of coal, one mile to the south-east, by means of their Wadsworth shaft, 666 ft. deep, to the Mammoth bed. The selection of this point was made after very careful survey, for several substantial reasons:—1st, to secure a large body of good coal, at a reasonable depth, partially opened by the slope already mentioned; 2d, locating it on the East Norwegian branch railroad, about 2 miles from the head of the Reading Railroad at Pottsville, and the nearest tide water at Philadelphia, and the canal terminus near Pottsville, on the southern edge of the southern coal-field, about midway of its terminal, the one 30 miles east, on the Lehigh River, at Mauch Chunk, and the other about 30 miles to the west, near Dunham, on the Susquehanna River. From the head of the railway 94 miles, and from the head of the canal 108 miles, tide water, branch railroads ramify and reach like ten fingers from the end of two long and strong arms gathering in the fossil coal. The product in 1866, from 152 collieries, was nearly 4,500,000 tons; 53 of these collieries lie in the Mahanoy region, north of Pottsville, from 8 to 20 miles distant, and produced 2,500,000 tons. The balance of 2,000,000 tons came from the 99 collieries south of the Broad mountain, and varied in distance from 2 to 12 miles from the head of the road. Of all these 152 collieries the above shaft is the nearest to market.

The site of the shaft was carefully chosen with reference to the geological structure of the district, and is exceedingly important, being on the long and gentle southern slope of the great anticlinal axis, which enables us to reach the Mammoth bed with a practical depth, and obtain a working length limited only by land boundaries or leases. This shaft commands a working length of coal miles in extent, but is at present limited by a lease, eastward 500 yards and westward 900 yards, or 1400 yards in all, and a breadth of 667 yards north and south, and above the water drainage at foot of shaft. This length multiplied by the breadth and again by the great thickness of the Mammoth vein—10 yards—gives a cubic quantity equal to 6,063,000 cubic yards or tons, to which we add the 7-ft. bed, averaging three yards in thickness, and the 4-ft. bed overlying the second foot, averaging 1½ yards, equal to 2,701,350, gives a total quantity of 8,764,350 tons, and of this immense quantity the ton farthest removed from the foot of the shaft is 1350 yards, and as this ton of coal is passing to the shaft, its route is over a self-acting plane of 470 yards in length, the haul by mule power will be but 880 yards, a matter of the greatest moment in the cheap production of coal. This central position of the shaft does away with the long and tedious hauls and the expensive gangways now so common in slopes and drift workings.

With reference to the details of the shaft, it was begun on Sept. 7, 1864. The surface was removed, making an excavation 32-30 ft. in diameter, 40 ft. deep to the first stratum of solid rock, using it as a foundation, a wall 4 ft. in thickness and 14-22 ft. inside of inclosure was carried up to the surface, and of this size the shaft was sunk. Thencever winter weather delayed the masonry and, consequently, the sinking until June 12, 1865: 12 days were lost in making sump in the Orchard Vein, 115 feet from surface, also 18 days in making sump in Primrose Vein, 320 ft. from surface, again 15 days in lowering pump from one sump to another, 12 days we were drowned out, 18 days men turned out, 6 days adjusting pump. Then from Oct. 19, 1866, to Feb. 28, 1867, and 12 days in May and June 1867. Making a total delay from June 12, 1865, of 203 working days. The Mammoth Vein was cut June 18, 1867, 2 years and 6 days, or 631 working days from June 12, 1865; deduct time lost, 203 days, and there remains 428 days spent in sinking from bottom of foundation walls to top of Mammoth Vein, a distance of 623 ft., or 1-45 100 ft. per day. The shaft is divided into three compartments of 4-12 ft., by 12 in. timbers placed about 4 ft. apart, from top to bottom. The surface water is caught by drains cut around the shaft, and by them is conducted into the sump in the Primrose Vein, from whence it is hoisted 320 ft. by an air pump, at present necessary to collect the small quantity made at the bottom of the shaft, but is hoisted by buckets, and is not over 60 gallons per day. During the sinking of the shaft no artificial means of ventilation were used, nor is there now, although the gangway is 200 ft. west, from the foot. Ordinarily in sinking a well 60 feet deep ventilation is difficult, but at this shaft a simple contrivance, and a partition in the shaft so creates a draught that pure air is abundant at the face of the gangway, and everywhere through the workings. English colliers frequently sink an extra shaft for ventilation.

Vith reference to the capacity of this shaft, we beg to show what others have and are doing abroad. As our experience in the Pennsylvania coal is limited thus far, and merely experimental, we select from among the principal collieries as follows, premising what they can do at great depths we can do more readily at less.

Name	Owner	Depth.	Capacity per day.
Houghton Pit.....	Lord Deedham.....	260 yards.....	1170 tons.
Seaton Delaval.....	J. E. Foster.....	224 yards.....	1000 tons.
North Seaton.....	J. B. Foster.....	218 yards.....	1200 tons.
Ryhope Colliery.....	John Taylor.....	560 yards.....	2000 tons.
Dukinfield.....	.....	686½ yards.....	500 tons.

This latter shaft furnishes a striking example of the enterprise of English capitalists, and is in good contrast with our American shaft. Work upon it began in 1847; at the end of five years it reached the depth of 476 yards. In July, 1858, ten years after its beginning, the shaft had obtained a depth of 1059½ feet, or 686½ yards. The material sunk through is—Rock, 211 yards; shale, 44½ yards; coal, 32 yards; total, 686½ yards.

From the bottom of this shaft a slope is sunk 250 yards, at an angle of 1 ft. to the yard, making the total depth 936½ yards, and the vertical height 770 yards from the surface. Much difficulty was experienced from meeting with springs of water. For 29 months the progress of the sinking was but 17 ft. per month. The general diameter was 12 feet, at the centre 12½, to allow for passing, and at the bottom it was enlarged to 19 ft. 2 in. It is tubbed with cast-iron segments for a distance of 42 yards, then lined with 2-in. wall of arch bricks, stiffened at intervals with stone rings, 18 in. on the bed and 12 in. thick, of which there are 90; altogether 7308 cubic ft. of stone, and 750,000 bricks have been used in the shaft, exclusive of those used in the mouthings. The total cost was \$500,000, and developed 32 yards of coal in 26 years of more than a foot in thickness, 15 of which have an aggregate thickness of 58½ ft. This enterprise was successfully completed by winning the "Black Mine," a fine seam of coal 4 ft. 8½ in. thick, and calculated to last 30 years at 600 tons per day. We may infer, therefore, that the grand object of this immense undertaking was to develop the "Black Mine" coal, a fee 8½ in. thick.

The American shaft develops but ten seams of coal, as follows:—The coal, at

40 ft. deep, 1 ft. thick; the coal, at 94 ft. deep, 4 ft. thick; the Orchard, at 115 ft. deep, 6 ft. thick; the coal, at 318 ft. deep, 1 ft. thick; the Primrose, at 320 ft. deep, 10 ft. thick; the Holmes, at 402 ft. deep, 4 ft. thick; the Rough vein, at 490 ft. deep, 4 ft. thick; the Four-foot seam, at 627 ft. deep, 6 ft. thick; the Seven-foot seam, at 689 ft. deep, 10 ft. thick; and the Mammoth, at 669 ft. deep, 30 ft. thick; total thickness of coal, 76 ft.

Its object, however, was to win the Mammoth and Seven-foot coals, together 40 ft. thick, and all the most productive and reliable beds of the anthracite regions; they, at the depth of 222 yards, or less than one-third of the "Black Mine," can certainly send to the surface double the estimated quantity of the latter, or 1000 tons per day. We, then, shall assume 500 tons per day for 500 days, the American mine. To pay the interest on the English investment—say, 6 per cent, on \$500,000—would impose a tax of 20 c. per ton on the product of the mine, exclusive of the interest on the original cost of the land. The cost of the mine, rican pit was \$147-50 per linear foot of depth, making for the 666 ft., including cost of temporary hoisting engine..... \$99,231-10

Cost of permanent, hoisting, and pumping engines, and other outside improvements..... 50,000-00 = \$149,231-10

The interest on this cost of (say) \$150,000, or \$9000, is equal to a tax of 8 c. per ton on the yearly product of the mine. The English estate contains 1283 acres waste, a 1000 tons per day for 20 years, or 1/4 more coal in 1-6th the area of the English mine. In this connection we beg leave to show the product of the English mines and the Pennsylvania anthracite for the last four years:—

Year	English Tons	Pennsylvania Tons
1863	88,292,515	9,631,101
1864	92,789,873	10,184,270
1865	98,130,287	9,652,391
1866	101,630,848	12,703,883

Coal areas.	Square miles.
Bituminous of United States.....	133,132
" British America.....	18,000
" Great Britain.....	8,139
Anthracite of Great Britain and Ireland.....	8,720
" Pennsylvania.....	470

If we thus contrast the comparatively small amount of Pennsylvania anthracite, its easy and cheap development and production, and its convenient access to the sea board we must be impressed with its great importance and consequent value. SHEAFER BROTHERS, Mining Engineers, Pottsville, Pa.

— The Miners' Journal, Pottsville, U.S.

#### HYDRO-CARBON AS A FUEL.

[From F. H. THOMSON'S Introductory Address to the Glasgow Philosophical Society.]

Of late attention has been drawn to the probability of utilising the hydro-carbons as fuel, and as this is a matter of great practical moment I shall mention some facts, to illustrate to what extent experiments have been made, and with what results. Government, in 1856, ordered certain experiments at Woolwich Dockyard, with the view of testing the value of petroleum and shale oil as a substitute for coal in raising steam in marine boilers. The experiments were carried out extensively by Mr. Richardson, upon American petroleum, English coal oil and shale oil, Burslem oil, and Torbane Hill mineral oil. Fifteen separate experiments were made, the duration of which varied from 2 hours 25 minutes to 10 hours 20 minutes. The total weight of oil used for getting up steam was 499 lbs., and 4755 lbs. for the whole experiments. Taking the average of the whole experiments, it appears that 13-2 lbs. of water were evaporated per lb. of oil. The lowest results of the series were those given on two consecutive days by a mixture of American oil and coal oil once run, burned in three furnaces. On the first day, 7-77 lbs. of water were evaporated per lb. of this mixture, and on the second day 7-14 lbs. of water per lb., a result lower than that obtained from coal burned in the ordinary way. The result of these experiments was not very satisfactory, the combustion having been imperfect. The report gives a detailed description of each experiment, which, although interesting enough in themselves, do not seem to have been very successful; but, on the whole, the experimenter seems to give the preference to Torbane Hill mineral oil, and Burslem oil, which he evaporated the water at the rate of 18-35 lbs. per lb. of oil. The smoke was very moderate, and the tubes at the conclusion of each experiment were tolerably clean. The report concludes that the experiments, so far as they have gone, may be regarded as of considerable value, as showing the great evaporative power of these oils, and the practicability of their utilisation. In an economic point of view, there may be some doubts of the value of this application. At the present price of petroleum oil, it is not easy to suppose that any considerable saving could be effected; and so far Mr. Richardson's experiments, which, however, are only initiatory, do not promise much. But various parties are now turning their attention to this important subject, and certain experiments which were instituted by Mr. Barff have resulted in the formation of a limited company in London, called the Sim and Barff's Patent Mineral Oil Steam Fuel Company; and they introduce themselves by stating that they have taken out a patent for utilising the lighting and heating properties of petroleum, tar, oil, naphthalene, and other heavy inflammable hydro-carbons, that have hitherto been comparatively useless on account of the difficulty experienced in combining with them, at the burning point, sufficient air to cause perfect combustion. Some ideas may be formed of the commercial value of the lighting and heating properties of these heavy oils, from their possessing three times the evaporating power of coal, requiring much less space for storage, and thus effecting a great saving in labour. On this account Messrs. Sim and Barff affirm that these oils are doubtless destined to form the marine steam fuel of the future. They add that by their process no alterations of existing furnace arrangements are required.

In the Times of Jan. 28, 1867, there was an elaborate report by Prof. Bixham upon experiments which were made at Messrs. Jackson and Wainman's Mill, by the patentees; and although too extended to be more than alluded to in the notice, the results are satisfactory. He concludes by saying—"The boiler tested at Millwall was a return fire boiler, and, although of unfavourable proportions, some good results were obtained. With the boiler three parts filled, the pressure gauge indicated 25 lbs.; in three minutes it was 30 lbs., the safety-valve being eased at this pressure. With all these disadvantages to contend with, the gentlemen present expressed their complete satisfaction with the results; and as a company has been already formed to work this patent, we may be interested to the result of their future trials. The simplicity and easy adaptability of the apparatus to existing boilers commends itself at once to the attentive consideration of the public. A vessel of the size of the Persia would save alone by extra cargo, in using this fuel for a return voyage to New York, no less a sum than 3000l. By this method the rate of evaporation, actually obtained in a boiler very unsuitable for the purpose, has been the highest ever known—22 lbs. of water to 1 lb. of oil, or in the proportion of almost 4 to 1 against ordinary steam coal; thus, a saving of two thirds of the space on board ship now occupied for the storage of fuel is effected, and made available for carrying cargo; so that, although the actual cost of the fuel is greater, weight for weight, than that of coal, still the increased cargo-carrying capacity causes such diminution in the cost of running a steamer as to leave a large margin for profits. For naval purposes the importance of adopting this method cannot be overrated. It is well known that many of our iron-clads, with their complete armament on board, are able to carry only three or four days' supply of coal. In the application of this method to the manufacture of iron, it may be stated that some of the most rapid meltings ever effected have been obtained by the use of the patented method, thus showing its high efficiency under another aspect." The same gentlemen have also practically carried out a patent by J. Kidd for using the dead oil of tar, or any dead oil, for carburating the common coal gas. Mr. Barff writes me, stating that the gas engineer of the London and North-Western has reported upon it, and the company is to have the lighting of the departure platform of the Euston station. A train of twelve carriages is at present running on the North-Western between Broad-street and Chalk Farm, six of them lighted by Sim and Barff's process, the others working a patent by Prof. Bixham. The latter gentleman uses, however, an explosive oil, which he passes over the bag in which the gas is kept in the guard's van, whilst the others use essentially dead oils, which for safety and economy seem to carry the day. It may be interesting to devote a minute or two to the peculiar qualities of these oils, in combination with carburated hydrogen, for lighting purposes, and to note some of the results which emerge in an economic point of view. The patentees state that 1 ft. of coal gas will absorb from 20 to 30 grains of the oil, by which the heating power is increased upwards of 400 per cent. Thus, 1000 cubic feet of coal gas, costing 4d., will absorb five pints of the prepared oil, costing about 11d. total cost, say 2s. 6d. It will then give out an illuminating power equal to 5000 cubic feet of gas, which costs 2s. 6d.

In the metropolis there are 45,000 public lamps, on which an immense yearly saving might be effected by the application of Kidd's process, as employed by Messrs. Sim and Barff. In proof of this, each street lamp in London and its vicinity is computed to consume 5 cubic feet of gas per hour, the average time of burning being 12 out of the 24 hours. Thus each lamp consumes 60 cubic feet of gas per night, which is equivalent to 22,000 ft. per annum, and the average annual consumption being 22,000 cubic feet, this brings the annual cost of each street lamp to 4l. 19s.; whilst by the application of the carburated oil the expense is reduced to 2l. 7s., effecting a saving on each lamp of 2l. 12s., and giving a light of 400 per cent. greater. Again, Messrs. George Miller and Co., Rumford Street, have interested themselves to some extent in the question of the application of oil as fuel, and have now working a large furnace used in heating gas, and boiler, heated entirely by the application of tar oil, the refuse of gasworks, and steam. The simplicity of their arrangements is certainly very remarkable, and to my idea solves the question of the absolute combustion of the hydro-carbon liquid. The difficulty of burning these oils simpler has hitherto arisen from an accumulation of coke, arising from the uncombusted carbon accumulating at the bottom of the furnace. In this furnace all is consumed, and the interior is perfectly pure and white. In carrying out this arrangement, the bars of the old furnace had been removed, and the space filled with fire-bricks. A pier was raised, rounded on the edges so as to allow an easy play of the flame. The ordinary door is still used, but over it is an iron door, through which two nozzles are introduced, projecting about 6 in. into the furnace. These nozzles have kneed continuations of two pipes coming from the tar reservoir, each pipe having a stop-cock to regulate the supply. At the knee of each tube steam is introduced, which meets the tar oil as it descends. One or both of the nozzles may be brought into play. When I saw the furnace working the full power was on. When an additional supply of oxygen is required the door is slightly opened. Messrs. Miller state that two tons of tar oil, at 1d. per gallon, gives out an amount of heat equal to three tons of the best coal; and that, in an economic point of view, at this rate, and with the oil at the hand, the expense is much the same. Their works, being contiguous to the gas manufactory, gives them facilities as to the supply of the tar liquid which are almost unbounded. But even taking all the difficulties into consideration, when we calculate the magnitude of the



savings to be derived by sea-going steamers, the importance of such an application cannot be over-estimated.

Many people have been working at this question; and, amongst others, Mr. Swan, of Edinburgh, has taken out a patent for a combination of hot air and petroleum, to be used in the melting and forging of iron, and is about to carry out extensive experiments in the blast furnace. His experiments are interesting, and show the importance of steam or air, in combination with these oils, to effect perfect combustion. He states that, in using the oil alone, a thick deposit of carbon is thrown down, and little heat obtained; but when the hot air was used in combination, little or no smoke was evolved, and an intense heat was got up at once. Again, Sir Jas. Simpson, of Edinburgh, lately applied for a patent for improvement in the utilising of mineral oil and other oils for the production of heat, and for illuminating purposes. He claims the use of either steam or air forced through tubes by blowing apparatus, the object being to break the jet of oil into spray, to facilitate its ignition. The patent has not been proceeded with, in consequence, I presume, of the other patents having forestalled him. The exact amount of saving, and the quantity of steam or air required for absorption, has not yet been quite ascertained; but much has been done in proving that the right path has been entered upon; and the subject is in itself of sufficient importance to invite our attention.

#### FOREIGN MINING AND METALLURGY.

Some transactions of little importance to meet current wants, and one or two more considerable affairs in iron and girders, are the only matters to note in connection with the Belgian metallurgical market. Upon the whole, the situation does not improve, and but for some rather important orders received from abroad a few years since a considerable number of the forges would be in a critical state. The country on hand will be soon completed, and, unfortunately, no new work of any importance presents itself on the horizon. Under these circumstances, there is reason to believe that contracts announced as about to be let by the administration of the Belgian State Railway will be keenly disputed. It may be noted that at two recent adjudications at Rochefort on account of the French navy the successful competitors were Belgian works, notwithstanding the extremely low prices offered by French works. The first affair comprised the transformation of 75 tons of cast iron into plates and flat iron. M. Victor Gilleux, of Charleroi, obtained the contract at 61.18.4d. per ton. The second affair comprised the transformation of 182 tons of cast iron into plates, 15 millimetres in thickness (3/16 in. English); the contract was allotted to M. Deleuxy, Gerardon, and Co., of Jemeppe, at 61.78.3d. per ton. The Austrian Company for the Manufacture of Chemical and Metallurgical Products will pay, Dec. 1, a dividend for the exercise 1866-7, of 41. per share. The Phoenix Mines and Ironworks Company (Prussia) will pay, Jan. 2, 1868, a dividend for the exercise 1867-8, of 11. per cent. per annum. Meetings are announced as follows:—Austro-Belgian Metallurgical Company, Nov. 26, at Corphalle, near Huy; Carlsruhe Company for the Construction of Machines, Nov. 27, at Carlsruhe; and Bois Colliery Company at Quaregnon, Nov. 28, at Quaregnon.

Several small orders, of no great importance in the aggregate, have been made some persons to think that the state of French siderurgy was improving; but this view of the case is not accepted on all sides. The few orders in question have enabled the blast-furnaces to be maintained in activity in the Haute Marne; but many of the forges remain, nevertheless, idle. Rolled coke-made iron remains nominally quoted at 71.48. per ton; mixed pig, at 88.48. per ton; and charcoal-made pig, at 81.16. per ton; with a scale of 48. to 88. per class; reductions from these terms are, however, made in the case of contracts of any importance. In the Meurthe and the Moselle prices do not improve, either pig or mineral; the stock of pig continues considerable. The fabrication of pipes is now being carried on with some activity in the Meurthe. An establishment of this group has obtained an order for the delivery of castings required for gasworks at Constantine. The furnaces which work refining pig in the Moselle are all lighted; several contracts are mentioned as in course of negotiation. It was stated some time since that MM. Dupont and Dreyfus had abandoned a contract which they had secured for the delivery of cast-iron pipes required for the town of Metz. The terms on which the contract was let to MM. Dupont and Dreyfus were 32. per ton, for the local authorities again offered the contract for public adjudication, and the affair has been let to MM. Lang and Co., at 61.12. per ton, showing a difference of 11.16. per ton in favour of the town. This considerable abatement from terms deemed insufficient by the first contractor shows how keenly the French works are seeking employment. Meetings are announced as follows:—Epinac Collieries and Railway Company, Nov. 26, at Paris; Basse-Indre Forges Company, Nov. 29, at Paris; Province de Santander Mines and Foundries Company, Nov. 29, at Paris; Franco-Comte Blast Furnaces, Nov. 30, at Besancon; Fontignaud Mines Company, Nov. 30, at Paris; Ahun Collieries Company, Dec. 5, at Paris; and Ferlay and Ames (Pas-de-Calais) Colliery Company, Dec. 11, at Douai.

The Belgian coal trade has not presented any very great activity as regards secondary descriptions. This state of things, which is somewhat exceptional for this period of the year, arises from various causes, among which may be mentioned, in the first rank, the approaching termination of the season of the sugar-works, which are now supplied as regards the remainder of the year. The state of industrial affairs generally is little calculated to revive the coal market; but we must not forget that the coal which has arisen between the proprietors of works in the suburbs of Paris and the administration of that capital—and which has occasioned the closing of several establishments—has materially contributed to the aggravation of the situation as regards secondary coal qualities, stocks of which are accumulating. In the Liège basin the demand is active, and prices are pretty well maintained at 12s. per ton for all coming qualities. The deliveries by boats in the Coucheant de Mons leave much to be desired; on the other hand, freights display an upward tendency. The total profit realised during the past exercise by the Belgian Company for the Construction of Engines and Railway Plant was 25,000, of which 18,000 was carried to the reserve, which now amounts to 39,000; 2,447 was carried in reduction of the account relating to the obligations of the North-Western of Spain Railway Company, which the company has held for several years, and which now figure in the balance-sheet at 10d. each. Interest at the rate of 5 per cent. per annum, or 11. per share, was distributed on the share capital, and finally a sum of 1437 was carried forward to the credit of the next account. The capital account of the company was reduced during the past year, to the extent of 1201, by the sale of apparatus past service; mechanical tools purchased last year at the cost of revenue to the extent of 1793, while the workshops were extended at the cost of the same account to the extent of 254. The affairs of the company thus appear to have been administered during the past year with commendable prudence. As regards the current exercise, the report states that it presents somewhat less activity, and during the last three months the staff of workmen and employees has been sensibly diminished. Work is, nevertheless, not absolutely wanted, and the negotiation of some important orders is being pursued with activity. The company obtained at the Universal Exhibition at Paris a gold medal in the class of railway plant, and a silver medal in the class of general mechanical industry.

Chilian copper has hardened on the Havre market, and disposable is now held at 711. per ton; as regards old copper, the sale is noted of 21 tons, which made 662.8s. for red, and 487.8s. for yellow, and 12 tons of old French yellow, which brought 511. per ton. The stock of copper at Havre at the close of October was estimated as follows:—140 tons of United States, 3470 tons of Chilian in bars, 430 tons of ingots, and 50 tons from various sources, making a total of 4660 tons, or of pure copper about 9200 tons, against 4370 tons in Sept. 29, and 4320 tons Oct. 31, 1866. Although the demand has rather moderated at Paris, the tone of the article is more satisfactory; Chilian yielding 96 per cent. is quoted firmly at 711.10s.; English in plates at 781.; United States, Lake Superior, at 881.; and Corocoro mineral, 751. per ton. The German copper markets display a better tendency; at the same time, the demand does not exceed the current requirements of daily consumption. No important change has occurred in the Dutch tin markets; there is, however, a little more firmness in Banca, which is quoted at 53 1/2; it might, perhaps, be quoted at 53 1/4, if there were not a scarcity of sellers below this latter price; and, having regard to the healthy tone of the article, it is believed that the least demand would cause the price of tin to rise to 54.1s. or 54 1/2. As regards Billiton, a lot of 250 ingots has been dealt in at 52 1/2, one lot closing at 52 1/2. The Paris tin market has been quiet; Banca has made 961.8s.; Straits, 941.8s.; and English, 941.8s. per ton. At Havre, a lot of 506 saumons of Peruvian tin has been quoted at 841. per ton, Paris conditions. There is no change in the tone of the German markets, on which the demand is moderate. The lead market shows no change in price, with but little business doing. The Breilian zinc market shows a tendency to revive. The demand on the Hamburg market has also gained a certain activity. At Paris prices have been sustained, Silesian at 221.10s., and zinc from other sources 221. per ton.

#### MINING IN AUSTRALASIA—MONTHLY SUMMARY.

The mail from South Australia brings news to Sept. 28. A Bill has been read a second time in the Assembly, authorising Government to offer a guarantee of 1 per cent. for 30 years on a railway from Port Augusta to northward, to be 200 miles in length, and adapted both for horse and locomotive traction. A great deal of rain has fallen in the month, and the prospects for the next harvest are favourable. The agitation among the unemployed has ceased, and the labour market is so much improved that a speedy resumption of immigration is anticipated. The threatened strike of the miners at Wallaroo has been averted, and the men are all at work again. Kerosene shale has been discovered in the vicinity of Old Cornwall Mine, Yorke Peninsula. The banks have reduced the rate of discount on 90 days' bills to 8 per cent., and on over-drafts to 10 per cent. per annum. They purchase bills at 60 days' sight at 1/2 per cent. dis., selling the same at 1 1/4 per cent. premium.]

#### AUSTRALIAN MINES.

YUDANAMUTANA COPPER.—The superintendent (Sept. 28) states: Y. D. Terrell, formerly at the Yuda, has been appointed captain of the Blinman Mine. A further reduction in wages has been made, and a more economical mode of working adopted. During the present month we have sold here 74 tons of copper and 3 tons of ore, the net proceeds of which, amounting to 51401., have been placed to the credit of the mine. The Breilian zinc market shows a tendency to revive. The demand on the Hamburg market has also gained a certain activity. At Paris prices have been sustained, Silesian at 221.10s., and zinc from other sources 221. per ton.

WORTHING.—Legg's engine-shaft is now (Sept. 28) down to the 120 ft. level; the ground in the bottom of the shaft is about the same as for the 200 ft. level, with small strings of ore running across the shaft. As soon as the necessary work is completed they will commence driving to cut the lode. In

the 73 south they have been stripping the side of the level east all the month, but have not yet reached the eastern wall, although the lode is nearly 18 feet wide, yielding good ore all through. In the 63 ft. level they hope soon to get into a good paying lode, as they have small branches of ore, and the water is coming away freely. The stopes have improved in quality, but are rather less in quantity. The prospects appear more cheering than for some time past, and they now being about to make their own copper the results will be far more satisfactory. Ore raised and dressed during the month, 300 tons; regulus, 49 tons; regulus on hand, 55 tons, and 112 tons of ore. Number of hands employed, 122.

GREAT NORTHERN COPPER.—Capt. Tonkin (Sept. 19) reports—I find the large deposit of ore was at the junction of the two lodes, and that after the removal of it the works were confined to the north lode, which was not very productive. I have since discovered a south lode of great promise, and which has not been worked to any extent. I am of opinion that this lode will be very productive going east.

ENGLISH AND AUSTRALIAN COPPER.—The quantity of coal at Kooronga was 72 tons, at Kapunda 50 tons, and at the Port 607 tons. There were three furnaces at work at Kooronga, and five furnaces and one refinery at Port Adelaide. A shipment of 100 tons of copper would be made in a few days from the date of writing.

PORT PHILLIP AND COLONIAL GOLD.—Mr. Bland, Clunes, Sept. 26:—The quartz crushed during the four weeks of August was 4938 tons, yielding 19500z. 8 dwts. of gold, or an average of 7 dwts. 21 grs. per ton. The receipts for the same period were 7222.28. 7d.; payments, 4232.8s.; profit, 2471.14s. 7d.; which, after adding the balance from last account of 427.13s. 11d. shows a total of 2514.8s. 6d. The amount divided between the two companies was 25001., the Port Phillip Company's proportion being 16251. The above return shows a considerable falling in the yield as compared with the July return, which latter was, however, unusually high, and there was in addition a considerable quantity of gold from pyrites; for the month of August there was but little from this source. The current month shows a considerable improvement in the yield of quartz, and this, with the pyrites now under treatment, will, I hope, give us a good average. The present month (September) will include six weeks. The following is the return for the first four weeks:—Quartz crushed, 4757 tons, yielding 2830z. 9 dwts. of gold, or an average of 11 dwts. 22 grs. per ton. The remittance received by this mail is 15001.

CADIANGULONG COPPER.—During the month there were sampled from the mine 72 tons of ore, averaging rather over 14 per cent. for copper, and yielding by assay 10 1/2 tons of fine copper. There have been shipped by the Brucklay Castle, for London, 9 1/2 tons of fine copper; there were in store at Sydney 2 1/2 tons, and in a forward state at the works 11 tons. Ore on hand, 75 tons; wood, 3000 tons.

SCOTTISH AUSTRALIAN.—The sales of coal from Lambton Colliery for August amounted to 15,378 tons. Mr. Young, the assistant superintendent, reports that the Government appliances and facilities for the shipment of coal had been improved. An arrangement of a general character between all the various colliery owners (with one exception) had been entered into, to take effect from Jan. 1 next, in virtue of which the price of coal would be somewhat increased. The coal trade, however, was becoming slack, owing mainly to the want of shipping for eastern ports.

#### FOREIGN MINES.

ST. JOHN DEL REY MINING COMPANY (Limited).—Advices received Nov. 2, per steamer Onida:—Morro Velho, Sept. 28.—Remittance received, 90,002.5 oits.—564,652 lbs. This remittance is the smallest we have sent in some time, arising out of a diminished supply of water, which reduces the tonnage duty of the stamps, and also from the particular state of both mines, the stopes have been working in during the greater part of the two months while this produce was extracted.

GENERAL OPERATIONS.—Since addressing you on the 17th current, our operations have been carried on regularly, as fully as the supply of water would admit of being done. Frequently we have been obliged to suspend many stamp heads, from not having sufficient water to work the whole. Advantage has been taken of this necessity for the suspension of heads, to have certain repairs done at portions of the stamps; and the whole of one side of the addition stamps has been stopped, in order to renew the sleepers, joists, and flooring of the eastern strakes. We have had a little rain-fall, which so far, though not augmenting our water-power much, is notwithstanding a relief to the parched up state of the surface we have been suffering from, but whether the rain may continue so as to afford any tangible increase of our water-power at this season is rather doubtful.

MINES.—At present the native force in attendance in the mines is quite as large as we require, and sufficient stone is quarried and delivered on the surface to afford a full supply of the ore for the stamps, and still have a little stock in the dressing floors. The pumps are acting well, and the hauling power doing very good duty, especially in the Cachoeira Mine. There is a large force of miners employed on the timberwork, and quite the average amount of work, especially repairs and replaves, accomplished.

EXPLORATIONS.—During the past fortnight there has been an adequate and steady mining force kept on this work, and the general results have been satisfactory. Both the drivings in the East Cachoeira are giving a fair supply of clean ore for the stamps.

REDUCTION DEPARTMENT.—The stamps duty is now decreased in proportion to the diminished supply of water, which, however, is not less now than during some previous years in this month. At the Praia the decreased supply of water is more sensibly felt than even at our general works in Morro Velho. There is a good supply of stone on the floors, and an abundant quantity of killas to afford sufficient hard material for the Praia stamps, which are well supplied with this material. The ore is now spalled smaller than usual, with the view of aiding the stamps in its reduction.

GAIA.—The water-wheel of the stamps is now ready for putting on the crowns, and segments, and the mason-work of one side of the stamps is well forward, as also one set of stamp frames. Sufficient force of both masons and carpenters are now employed on the work, which is going forward pretty well at present.

GOLD EXTRACTED TO DATE.—The produce from the stamps for the second division of September, being a period of 11 days, amounts to 13,593 oits. It has been derived as follows:—

	Oitavas.	Tons of ore.	Oits. p. ton.
From General stamps	8,597	from 1197.8	7.177
" Herring ditto, Bahu ore	2,790	from 1229.1	6.084
" Lyon ditto, M. and W. Cachoeira	2,206	from 999.7	6.612

Total stamps produce ..... 37,444 ..... 5514.2 = 6.730

Arrastre produce ..... 1,451 ..... = 0.263

Praia produce ..... 38,895 ..... = 7.053

Total produce ..... 40,962 oits.

This return is nearly 5000 oitavas more than was extracted in the previous month of August, when 359 tons less ore was reduced. August had one more working day, and a rather larger supply of water than we had in September. The general standard yield from the ore in August was 7.367 oits. per ton, and in September, as may be seen, it 7.053 oits. From the general mineral the yield is practically the same in each month, the decrease being in the yield from the eastern part of the Bahu Mine, as previously explained.

COST AND PROFIT.—The produce being ..... 40,962 oits.

Deduct loss in melting into bars ..... 201 oits.

There remains ..... 40,761 oits.

40,761 oits., at 7s. 9d. per oit. .... £15,794 17 9

Cost—Labour—Rs. 64,517 3/4 = Rs. 99,281 1/2 Ex. 1s. 9d. .... 8,687 2 1

Other charges Rs. 34,763 3/4

Profit for the month of September ..... £ 7,107 15 8

The labour cost is still heavy; the outlay for provisions is about the average; that for material is less than usual; the cost for the month in miltrels is the lowest we have had since September 1865.

The profit, considering our diminished water-power and the rather low yield of gold, may be regarded as good and satisfactory.

FERNAM PAES ESTATE.—Cost at Gaia amounts to Rs. 5,252 £127.

Ex. 1s. 9d. .... £ 459 11 2

MINES.—The following shows the average attendance of natives in the mines during the month of September:—

Natives boring daily ..... 302.76

Other ditto ..... 2.48 = 305.24

Natives working daily ..... 438.04

Others ditto ..... 460.00

Average daily ..... 928.04

This is a larger average attendance than we had in August by about 30 daily in the mine department. The quantity of stone hauled during the month amounts to 10,000 mine wagons, giving an average duty of 32.95 wagons per borer.

In the CACHOEIRA MINE no sinking has been done for the month, the borers being engaged in taking back the stopes east and west of the sump. The stopping has been carried out regularly throughout the month. No change has appeared in the lode, it still continues contracted in the middle section, but good, and almost free from killas in the eastern and western sections. Less heavy timberwork than usual has been done during the month, but a larger amount of replaves and general repairs have been executed generally, and especially in the Eastern Cachoeira.

In the BAHU MINE also no sinking has been attempted. The sump slope has been quarried back into and through the tongue of killas in that part of the mine, and the sump is now clear for sinking; a considerable number of borers have been employed in taking down some lode which entered into the south wall. Several new cross-places have been put in, and some repairs effected on the inclined-planes.

GAIA MINE.—The opening and driving on the lode north and south has been continued, and 44 wagons of ore added to the depot during the month.

On the Rago 30 fathoms of the embankment have been stopped, and 25 fathoms in length of masonry built, 5 ft. high by 4 ft. 8 in. thick. The stamps work has been advanced very considerably, and a very large amount of heavy masonry work has been done to support the parts of the excavation surrounding the wheel-pit, and space for the strakes. The crown segments are completed on one side of the water-wheel, and the frame for one side of the stamps is now in its place; a full force of mechanics is employed on the works, which is going forward rapidly.

REDUCTION DEPARTMENT.—The duty performed during the month of September in this department shows the following results:—

Stamps heads working 90 days, average	129.63 heads.
Ditto working 135 heads, average	28.89 days.
Arrastres each had worked, average	22.85 days.
Produce per stamp head per diem	9.600 oits.
Produce per arrastres per diem	3.868 oits.
Produce per arrastres on that of stamps	3.90 per cent.
The quantity of ore reduced amounts to	5514.2 tons.
Ditto of killas rejected and sent to Praia	3393.2 tons.
Ditto of sand amalgamated	3328 cubic feet.

The unrecovered gold contents amount to 1.644 oits. per ton, or 19.00 per cent. The proportion of killas rejected in September has been very large, as may be seen above.

The spalling has been smaller than usual, though from the diminished water-power the duty performed by the stamps is below the average.

PRIMA WORKS.—The produce extracted by these works is as follows, viz.:

By stamps re-treating sand with killas ..... 1286 oits.

By arrastres re-treating sand only ..... 781 oits.

Total ..... 2067 oits.

Considering the reduced water supply, and the slower rate of the machinery in consequence, the above is a very satisfactory gold return from these works. The arrastres have given larger average produce than those at Morro Velho.

GOLD EXTRACTED TO DATE.—The produce from the stamps for the first division of October, being a period of 11 days, is as follows:—

	Oitavas.	Tons ore.	Oits. p. ton.
From General stamps	8,465	from 1220.1	6.951
" Herring ditto, Bahu ore	3,232	from 1241.9	6.713
" Lyon ditto, M. and W. Cach.	2,199	from 981.9	6.076

Total ..... 13,896 ..... 2093.9 = 6.636

Although this is not large produce, it is quite equal to the return obtained during the first division of September, both as regards the daily produce from the stamps and the standard yield per ton from the ore treated. The yield from the East Bahu is better than during any division of last month. We have had a little rain-fall, so that the stamps have reduced about 90 tons more than in the corresponding division of September. The health of the establishment is at present pretty good, being free from any epidemic.

DON PEDRO NORTH DEL REY GOLD.—Capt. T. Treloar reports—The gold return for September amounts to 10,854 oits. (1254 ozs. Troy), thus:—

Wash-house ..... Oits. 2676

Strakes and stamps ..... 8178 = 10,854

PRODUCE AND COST

Produce, 10,854 oits., at 8s. 6d. per oit. .... £4612 19 0

Cost ..... 1833 16 11

Profit ..... £2779 2 1

I have the pleasure of forwarding the monthly documents for September, and considering the state of the wash-stuff has been little, a produce of 10,854 oitavas of gold, and a profit of 2779.2s. 1d. will, I hope, be satisfactory to the directors. At the mine the works have proceeded with vigour and regularity, but the lines of gold have been poor. The vein stuff, therefore, for the wash-house has been little; but of that little a portion has been obtained below the fissures and joints which destroyed the last bunch of gold. This is promising. The general work has yielded satisfactorily. The new washing strakes at Macquarie went to work on the 13th, and they are answering admirably.

PROGRESS OF SEPTEMBER.—Extract from letter, dated Oct. 18: Our operations generally are proceeding with regularity. At Macquarie we have had a small bunch of gold, but it lasted only two days. It was in the second line of gold, and whether it was an isolated bunch, or the beginning of a series of bunches, no one knows. Produce cleaned up to date 6405 oitavas (739 oz. Troy).

ANGLO-BRAZILIAN GOLD.—Capt. T. Treloar reports—The produce for September amounts to 2965 oits. (—342 oz. Troy) of gold, which exceeds that for August by 440 oits., with one working day less, although the stone treated is not equal in auriferous qualities to that of some former months, still, as no change for the worse has taken place in the size of the lodes worked on, and we have most promising ground opening on in the end south of Dawson's, we are still sanguine that the present falling off in yield is but a temporary one.

ROSSA GRANDE GOLD.—The directors have received advice by the present mail that Mr. Ernest Hilleke has accepted the appointment of superintendent of this company. No advices have come to hand from Capt. Brokenshar.

ALAMILLOS.—Nov. 11: In the third level, driving east from La Magdalena shaft, the lode is not quite so poor as when last reported on; it produces now 3 1/2 tons of ore per fm.; the ground is easier for driving. The fourth level, east of La Magdalena shaft, and the fourth level west of ditto, produce respectively 3 and 4 tons of ore per fm.; these ends are opening splendid ground. In the third level, east of San Enrique shaft, the lode is large, producing occasionally 1 1/2 tons of ore per fm.; this lode has improved during the past week, and looks promising for further improvement. In the fourth level, west of San Andriano shaft, the lode is large and strong, spotted with lead ore. The lode in the third level, west of San Andriano shaft, is composed of carbonate of lime and lead ore; of the latter it is worth 1 1/2 ton per fm. The ground in the third level, east of San Jago shaft, is easy for driving, and the lode yields 1 ton of ore per fm. In the second level, west of Crosby's cross-cut, the lode is small and poor, and the ground hard. The lode in the third level, east of Crosby's cross-cut, is split into several branches, and is unproductive.—Shafts and Winzes: At Taylor's shaft, below the fourth level, a part of the lode has again come into the shaft, which yielded some good stones of ore, but is at present poor. Berd's shaft, which yielded some good stones of ore, but is at present poor. Berd's shaft, below the third level, produced 2 tons of ore per fm. Rive's shaft, below the third level, has been communicated to the fourth level during the past week. Fernandes' winze produces 1 ton of ore per fm.; this is being sunk in advance of the fourth level, east of La Magdalena shaft.

LINARES.—Nov. 9: West of Engine-shaft—South Lode: In the 110, west of No. 152 winze, the lode is not so productive as when last reported on; it now yields 1 1/2 ton of ore per fathom. The 75, west of Warner's engine-shaft, produces 1 1/2 ton per fathom; the lode is large and strong, composed chiefly of soft spar and lead ore. In the 95, driving east of Taylor's cross-cut, east of engine-shaft, the lode, which is very wide, produces 3 1/2 ton per fathom. There is no improvement in the 95, east of Taylor's shaft, on the north lode, since last report. The lode in the 31, east of San Francisco shaft, on San Francisco lode, produces 1 1/2 ton per fathom; this lode is opening a good piece of tribute ground. Preparations are being made for sinking Warner's engine-shaft below the 75. No. 143 winze, below the 85, is going down in a very kindly lode, consisting of soft spar, and worth for lead ore 1 ton per fathom.

FORTUNA.—Nov. 10: Canada Inco—West of Taylor's Engine-Shaft: In the 100 fathom level, west of O'Shea's shaft, the ground continues hard for driving. The 90, west of Judd's shaft, produces 1 1/2 ton of lead ore per fathom; the lode has a very promising appearance, and is opening very good tribute ground. The lode in the 80 fathom level, west of Judd's shaft, is small, and the ground hard. In the 70, east of Carro's shaft, the lode is small, producing 1 1/2 ton of ore per fathom. The lode in the 55, east of Carro's shaft, is small, containing a little lead.—South Lode: In the 40, west of San Pedro shaft, the lode produces 1 1/2 ton per fathom; this lode has opened a piece of moderately productive ground in the past month. The 30, west of San Pedro shaft, contains stones of lead. San Pedro shaft, sinking below the 40, will be completed to the 50 in the present month. Gil's winze, below the 40, produces 3 1/2 ton of ore per fathom; this winze has reached the depth of the 50, and the men are put to drive west towards the shaft.—Los Salidos Mine: In the 100, west of Morris's engine-shaft, there is no alteration in the elvan cover, which continues hard. The lode in the 90 fathom level, west of Morris's engine-shaft, is disarranged, and unproductive. In the 75, west of Buenos Amigos shaft, the lode produces 2 1/2 tons per fathom; this is opening a very valuable piece of ground. In the 65, west of San Carlos shaft, the lode is composed of compact and solid, producing 2 tons of ore per fathom. The lode in the 100, west of Morris's engine-shaft, is divided into two branches, and has improved in appearance, producing now 3 1/2 ton per fathom. In the 90, east of Cox's, the lode continues unproductive. There is no improvement in the 75, east of Cox's shaft. The 65, east of San Miguel, produces stones of ore occasionally.—Shafts: San Pablos shaft, sinking below the 65, produces 1 1/2 ton per fathom; this is going down in a strong and productive lode. Buenos Amigos shaft, sinking below the 75, produces 2 1/2 tons per fathom; this shaft is being sunk through a very valuable piece of ground. The tribute department yielded the estimated quantity of ore in the past month, and has not undergone any unusual change. The surface work is going on very regularly, and the machinery is in first-rate condition. We estimate the raisings for November (five weeks) at 500 tons.

LUSITANIAN.—Nov. 12: Palhal Mine: At Taylor's shaft, sinking below the 110, the lode produces 5 tons per fm. for the length of the shaft, 15 ft. —Levels on Basto's Lode: The lode in the 90, east of Rive's shaft, is 1 1/2 ft. wide, composed of quartz and ore; of the latter 1 1/2 ton per fm. In the 110, east of Taylor's shaft, the lode is 4 ft. wide, composed of quartz, and worth 2 tons of ore per fm. In the 110, west of Taylor's, the lode is 1 ft. wide, worth 3 1/2 ton per fm. The 100, west of Taylor's, is 2 ft. wide, consisting of quartz, muncie, and stones of ore. The lode in the 100, east of Taylor's, is split into branches, which are composed of flookan, intermixed with country. The 70, east of Rive's shaft, is composed of quartz, and contains a branch of ore, yielding 3 1/2 ton per fathom; lode 4 ft. wide. The lode in the 38, west of Perez's shaft, is 1 ft. wide, containing stones of ore. The 70, west of the slide, is composed of quartz and small stones of ore. The lode in the 18, west of Perez's shaft, is small, and consists of quartz and a little flookan. The lode in the adit, west of Perez's shaft, is flookan, intermixed with soft country.—Levels on the Caunter Lode: The 70 and the 80, east of the slide, are composed of flookan. The 100, west of Basto's lode, and east of Taylor's engine-shaft, is 1 ft. wide, composed of quartz.—Level on Ponte Lode: The lode in 28, east of slide, is divided into very small branches, none of which are productive.—Level on Great Caunter Lode: In the 60, west of Oak engine-shaft, the lode is small, composed of flookan, spotted with lead.—Cross-cut: The 60 fm. level cross-cut, north of Rive's shaft, is formed of a hard gneiss. The 100 fm. level cross-cut, south of Taylor's, and the 28, south of Basto's lode, are each of the same character. The lode in No. 65 winze, below the 100, west of Taylor's, is 1 1/2 ft. wide, composed of quartz, muncie, and copper ore; of the latter it is worth 1 1/2 ton per fm. In No. 65 winze, below the 80, on new lode, the lode is 6 in. wide, yielding stones of ore.—Stopes on Basto's Lode: Above the 18, west of Fousaco's winze, the lode is worth 1 ton per fm. Above the 80, east of Domingo's winze, the lode is worth 1 ton per fm. Above the 80, east of Taylor's, the lode is worth 1 1/2 ton per fm. Above the 50, east of Ernesto's winze, the lode is worth 1 ton per fm. Below the 60, east of Rive's shaft, the lode is worth 1 1/2 ton per fm. Below the 80, west of No. 81 winze, the lode is worth 1 1/2 ton per fm. Above the 90, east of Taylor's, is worked out. Above the 90, west



of Taylor's, the lode is worth  $\frac{1}{2}$  ton per fm. Above the 90, east of No. 61 winze, the lode is worth 1 ton per fm. Above the 100, east and west of No. 60 winze, the lode is worth  $\frac{1}{2}$  ton per fm. Above the 110, east of Taylor's, the lode is worth  $\frac{1}{2}$  ton per fm. Stopped on the Caunter Lode: Above the 80, east of No. 59 winze, the lode is worked out. Below the 70, east of winze, the lode is worth  $\frac{1}{2}$  ton per fm. Above the 70, east of Tavar's winze, the lode is worth  $\frac{1}{2}$  ton per fm. Above the 50, west of Machado's winze, the lode is worth  $\frac{1}{2}$  ton per fm. Stopped on the Slide Lode: Above the 70, west of No. 66 winze, the lode is worked out. Above the 70, east of winze, the lode is worth  $\frac{1}{2}$  ton per fm. Stopped on Mill Lode: Above the 85, east of Taylor's, produces 1 ton of ore per fathom. Below the 70, east of Taylor's, produces  $\frac{1}{2}$  ton of ore per fathom. Stopped on Great Caunter Lode: Above the 50, east of Laurance's winze, produces  $\frac{1}{2}$  ton per fathom. Carvalhal Mine: In the 40, east of incline shaft, the lode is  $\frac{1}{2}$  ft. wide, composed of quartz, muddle, and stones of lead ore. The lode in the 40 west is 2 ft. wide, composed of quartz and stones of lead and muddle. The 30, east of incline shaft, is composed of quartz, with spots of lead intermixed with country. The lode in the 30, west of incline shaft, is 4 ft. wide, composed of quartz and muddle, and worth  $\frac{1}{2}$  ton of lead per fm.; we are probably near the caunter lode. The 20, east of incline shaft, produces  $\frac{1}{2}$  ton per fathom. The lode in the 10, east of incline shaft, is small, composed of quartz and muddle. In the 10, west of rise, the lode is 3 ft. wide, composed of quartz, spotted with muddle. In the rise above the 30, east of incline shaft, the lode is 3 ft. wide, composed of hard quartz, impregnated with lead. Stopped on Great Lode: Above the 200, east of incline shaft, the lode produces 2 tons of ore per fathom, and above the 200, east of No. 3 winze, the lode yields  $\frac{1}{2}$  ton per fm. Figueiredo Mine: In Henty's shaft the ground has proved heavier, and has required more timber than we anticipated, but we hope to complete it next Friday.

[For continuation of Foreign Mines see accompanying Journal.]

### Meetings of Mining Companies.

#### PRINCE OF WALES MINING COMPANY.

A quarterly general meeting of shareholders was held at the office, St. Michael's House, on Tuesday,

Mr. J. Y. WATSON, F.G.S., in the chair.

Mr. JEHU HITCHINS (the secretary) read the notice convening the meeting, and the minutes of the last were approved. A statement of accounts was submitted, which showed a balance of assets over liabilities of 24867.3s. The profit on three months' operations amounted to 6197.18s. 4d.

The report of the agents was read, as follows:—

Nov. 16.—Since the last general meeting Watson's shaft has been sunk 6 fms. 3 ft., being now 9 fms. below the 55; we hope to complete this lift to the 65 by the end of the month, when we shall commence driving south towards the lode, which we hope to intersect by the end of January. The 55 cross-cut has been driven north 8 fms., being now 16 fms. 3 ft. from shaft and 24 fms. north of main lode; the ground in the end is still mineralised, and letting out much water. The 55 east has been driven 5 fms., being now 22 fms. east of cross-cut; lode 3 ft. wide, worth 24d. per fm. The 55 west has been driven 2 fms. 3 ft. west of east cross-cut, being now 12 fms. west of cross-cut; lode 10 ft. wide, of a very promising character, now worth 20d. per fm. A rise in back of the 45 east is being put up 8 fms. 2 fms. from back of the level towards the new shaft, and which is down 16 fms. 3 ft. from surface, but at present is suspended, owing to the late heavy rains; we hope to commence sinking again within a few days. We have resumed driving the 45 west by two men; lode 2½ ft. wide, worth full 10d. per fathom, with every appearance of improving, and when the rise in the back of this end is communicated with the 30, which we expect to do some time next month, and which will give better ventilation; we shall then push on this end with a full party of men, from which we anticipate good results. A rise in back of the 45 west is being put up 9 fms., being now 12 fms. from back of the level; lode where last taken down is 2½ ft. wide, worth 10d. per fm. We have three stopes in back of the 55. No. 1, east of winze, by six men, worth 20d. per fm.; No. 2, west of ditto, by six men, worth 20d. per fm.; No. 3, west of cross-cut, by six men, worth 30d. per fm. We are getting on well with our sampling, and hope to sample 130 tons by the end of the month. In conclusion, seeing we have a good course of ore, with a large strong lode in both the 55 east and west and in the 45 west, lode 2½ ft. wide, worth full 10d. per fm., with every appearance of improving, and having no doubt but that the lode will be intersected and found good in the 65 by the end of January, we say the mine never looked so well as at this time, both for the present and the future.—J. GIFFORD, W. GIFFORD.

The CHAIRMAN having moved that the report be received and entered on the minutes, and that the accounts be passed and allowed, explained that against the cash in hand (which, including the ore bills, amounted to 21577.4s. 7d.) would be due next week Nov. cost and three months' bills, which would leave 12577.4s. 7d. The bill for engine, amounting to 250l., became due in December, deducting which there would be left 10077.4s. 7d.; and if the meeting adopted the recommendation of the committee, and declared a dividend of 1s. per share, there would still be left a balance of assets of 10077.4s. 7d. The committee were unanimously of opinion that to be financially potent, and to maintain financial soundness, it would not be desirable to distribute in the shape of dividends more than the amount actually earned during the past three months, which—in face of the suspension of operations on account of want of water, for a period of something like six weeks, and reducing the returns during the quarter by at least 100 tons of ore—amounted to 6197.18s. 4d. equal to 1s. per share. Of course they could but regret that the returns had been so considerably reduced, but it was satisfactory to know that the cause was not the poverty of the mine, but from the cause already stated—a temporary insufficiency of water consequent upon an exceptionally dry season. But the recurrence of such an impediment could not arise, as a suitable steam-engine had been purchased, and could be used whenever necessary required. He might also mention that in deference to some remarks made at the last meeting upon the subject of the usual statement of the usual statement, there had been prepared a profit and loss account of the quarter, which although it showed the same result, met the objection raised at the last meeting by a shareholder not now present. As Mr. Jehu Hitchens had just returned from a personal inspection of the mine, the committee had not thought it necessary to incur the expense attendant upon Capt. Gifford's presence at the meeting; and while Mr. Hitchens would be glad to afford any information he had obtained with reference to the position and prospects of the mine, it was satisfactory to know that he fully endorsed the opinion of Capt. Gifford when he stated that—"The mine never looked so well as at this time, both for the present and for the future."

Mr. E. COOKE said that, taking all circumstances into consideration, and remembering that such exceptionally retarding causes had operated against their remunerative progress, the result of the past three months' operations was most satisfactory, and the recommendation of the committee should be supported by the shareholders, as it could not fail to consolidate confidence in the financial administration of the enterprise.

Mr. ROSEWARNE said, as they had yet to pay for the engine, the question was whether any dividend should be declared upon the present occasion.

The CHAIRMAN said that, in addition to the amount standing to the credit of profit and loss upon the past quarter's operations, there was a large balance in hand, sufficient, as he had shown, to liquidate the current costs, and to pay for the engine, and then there would be left some hundreds of pounds in the treasury.

Mr. JEHU HITCHINS, in reply to a question from Mr. PETER WATSON, stated that he believed in the 55 fm. level cross-cut there was yet more lode standing south. It would probably be recollected that the reports some time since referred to a branch coming in south. He thought that branch was now coming in diagonally; there was a sort of splice which had thrown the lode further south, and for this reason he should recommend the cross-cut being continued in that direction.

Mr. ROSEWARNE endorsed that recommendation, for, apart from the reason suggested by Mr. Hitchens, there were other lodes very near. He considered that as their operations deepened they would have a first-rate lode south. He also thought the north lode would be cut productive.

Mr. HAMILTON said that some people supposed the north lode had been cut. Mr. ROSEWARNE knew from his own personal inspection it had not been cut. Mr. E. COOKE's opinion was that the lode had not been cut, but that it had been passed through in the shaft in the 30 fm. level.

Mr. ROSEWARNE said it was a matter of impossibility. It would have been impossible to sink the shaft without finding the lode out. The fact was the lode was going more "downright," or, in other words, more perpendicularly, and hence they had a further distance to drive to reach it; as yet they had scarcely driven a sufficient distance, even supposing the north lode had not changed its underlie. One fact, however, should be forgotten—that when the lode made more "downright," it became more productive.

Mr. HITCHINS said he had ascertained they had a lode there, but, as Mr. Rosewarne had explained, it had assumed a more perpendicular direction. The lodes underlie from the granite south, and this lode was in the kiltas, at perhaps 200 fathoms from the granite—in fact, underlying with the granite.

Mr. PETER WATSON: How wide is the lode?—Mr. HITCHINS: About 2 feet. Mr. ROSEWARNE said while inspecting the property he discovered another lode further north—further, indeed, than anything ever seen in that district. He had no hesitation in saying that, even including that discovered in Hington Down, he never saw the back of any lode which presented such favourable indications as that further north of the present north lode. He saw upon the back of that northernmost lode rocks of ore of unusual size. He believed the junction of the three lodes—a most important point—would be reached by a continuance of the cross-cut.

Mr. HITCHINS said that was a very favourable feature in connection with their property, but they had no object nor desire to "pudd" their mine, and they were very well content to speak of it as it was. Reasoning, however, from analogy, the point referred to by Mr. Rosewarne was the richest part of the set.

Mr. PETER WATSON said they had a long course of ore as it was. Mr. HITCHINS said that in the 40 fm. level they had driven upon it for about 70 fms., 50 fms. to fact, and 20 fms. the entire length almost through ore.

Mr. E. COOKE said that he had been in the mine a few weeks since, and Capt. Gifford, in reply to his question, stated that the shaft was sunk in its present position simply because it was in the centre of the set, and not because it was at the richest point, which, he believed, was yet to be reached. There was every reason to hope that there would be great courses of ore both east and west.

Mr. F. G. LANE enquired the present value of the reserves?—The CHAIRMAN said that an independent authority soon after the last meeting valued the reserves at 20,000l.—Mr. HITCHINS said that since then they had discovered as much ore as had been taken away.

Mr. LANE asked if Mr. Hitchens would confirm that valuation?—Mr. HITCHINS said that he valued them at about 18,000l., and since then they had not been diminished, for they were certainly discovering as much ore as taken away.

Mr. E. COOKE said much misapprehension as to the actual position and value of the mine had been created by the reports of certain inspectors, who were well-known to great speculators, and, therefore, allowed their interest to warp their judgment.

Mr. PETER WATSON said at the last meeting something was said about silver in the cross-course. He wished to know if anything subsequently had been done with it?—Mr. HITCHINS said they invariably assayed their samplings for silver, but the best assay they could arrive at was that when the average sales made

14s. per unit for copper the Prince of Wales ore fetched 16s.—they presumed it arose from the fact that it contained silver; certain it was that the bidders for their ore knew how to extract silver from it.

Mr. E. COOKE asked if the cross-course had been assayed?—Mr. HITCHINS said that would be come to in due time. They had not lost sight of it. In reply to further questions, he stated that he calculated the pumping-engine would last them two years longer at least.

Mr. E. COOKE said with reference to the mine in depth, there was certainly everything to indicate they would have good a lode in the 65 as in the 55.—Mr. ROSEWARNE saw no reason whatever to expect anything else, so long as the cross-course continued of the same character and size as in the shallower levels. To the present depth, the cross-course had kept the same size, and, therefore, they had a right to expect a continuance of the deposits of ore.

The motion for receiving the report, and ordering it to be entered on the minutes, and passing and allowing the accounts, was put and carried unanimously. Upon Mr. E. COOKE's proposal, seconded by Mr. DAUKES, a dividend of 1s. per share was declared.

A vote of thanks to the Chairman and directors terminated the proceedings.

#### WHEAL KITTY (ST. AGNES) MINING COMPANY.

A general meeting of shareholders was held at the offices, Austinfriars, on Tuesday, Mr. T. REECE in the chair.

Mr. E. KING (the secretary) read the notice convening the meeting, and the minutes of the last were confirmed.

A statement of accounts was submitted, which showed a profit on the three months' operations of 4997.10s. 3d., the balance in favour of the mine being 850l. 8s. 4d.

The report of the agents stated that the tribute pitches continued to yield their usual quantity of tin, and they hoped to raise a similar quantity for the ensuing quarter, as credited this day.

The CHAIRMAN moved that the report be received and entered on the minutes, and that the accounts be passed and allowed. From the information received from the manager, the committee believed they were justified in recommending a dividend of 2s. per share, which would leave sufficient amount to be carried forward to declare another dividend of like amount.

Mr. KING read a letter from Capt. Teague, stating that they had sold 47 tons of tin during the quarter, and, from the productive character of the lower levels, he estimated they would have the same return during the current as during the past quarter. The one thing desirable was a better price for tin, for, even with the late rise, they were realising 20d. per ton less than three years since.

A SHAREHOLDER considered it very prudent to continue to drive the cross-cut and to have the level of the mine by means of a similar cross-cut that Pryor's lode was discovered. And from the position of this cross-cut, it might be the means of cutting two or three side lodes, and that would, of course, considerably enhance the value of the property.

Mr. KING considered the report very satisfactory, and he hoped that at the commencement of another year, with an improvement in commercial matters, there would be a corresponding improvement in the value of metal, and the accounts were passed and allowed. A dividend of 2s. per share was declared. The committee of management were re-elected.

A vote of thanks to the Chairman terminated the proceedings.

#### NORTH WHEAL ROBERT MINING COMPANY.

A special general meeting of shareholders was held at the offices of the company, Austinfriars, on Tuesday, when it was resolved to prosecute the works, in consequence of the discovery of a very promising and productive lode in the eastern part of their set.

The level in which the discovery has taken place is a 62 fm. level driving east on one of a series of lodes converging in that direction towards a great cross-course. An additional proof of the value of the lodes in this hitherto unexplored part of the set is from the discovery of rich stones of ore, interspersed with gossan in the adit above, and the discovery of a gossanous character. Another incentive to keep this mine working is the small cost with which it can be done, as both the pumping and hauling is performed by water-power, the former by a wheel of 40 ft. diameter, and the latter by a 25-ft. wheel. There is also an important prospect looming in the Western Mine, where there is a powerful steam-engine connected to a shaft sunk 80 fms. deep, and with a short distance of the boundary of Sorridge Mine, which now bears the aspect of a similar discovery at a much less depth in North Wheal Robert.

The following reports were received from the agents:—

Nov. 18.—Since the last meeting the 62 fathom level has been extended east of Murchison's engine-shaft about 23 fathoms; through 20 fathoms of this drive the lode has varied in size from 2 to 5 ft. wide, and at times yielded good stones of ore. Within the last 3 fathoms the lode and strata have changed their character, and the lode became more productive, now yielding good saving work. From the appearance of the lode in the present end, and such good indications in the adit above, I cannot but think that if the end is continued, we shall very shortly discover a good course of ore, as we are approaching the great cross-course and the junction of other lodes.—W. GODDEN.

Nov. 18.—I went underground in this mine on Saturday last, the 16th instant. The only point now in operation is the driving of the 62, east of Murchison's shaft. The lode here, for the last 3 or 4 fathoms driven through, and in the present end, contains some rich yellow copper ore, mixed with friable spar, white flouk, and sulphureous muddle. The lode in the last 4 fathoms has undergone a very favourable change, and at present it looks highly promising, and I can earnestly recommend it for a further and more spirited prosecution. From Murchison's shaft eastward scarcely anything has been done, but the extending of the adit through the set, and the driving of the above-mentioned 62 fm. level, which is now in about 90 fathoms east from the said shaft. In driving the adit a great many valuable deposits of copper ore were discovered in the eastern ground, as well as in the western portion of the set; and although the lodes in the adit have been worked to some considerable depth with very favourable results, the same lodes to the east of Murchison's shaft remain, to a great extent, unexplored below the adit. These lodes are traversed by a cross-course, about 80 fathoms to the east of the 62 fathom level end, herein stated, at which place it is probable that they contain more ore than has hitherto been met with in this direction. The lodes standing to the north and south can be easily intersected by cross-cuts, as the lodes in the set are most favourable for the crushing of the ore, are done by water-power, therefore, under any circumstances, the mine can be very cheaply worked.—W. H. RUTTER.

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